



BERT APERLOO

ZIRCONIUM

Element Symbol: Zr

Atomic Number: 40

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Zirconium is a very strong, malleable, ductile, lustrous silver-grey metal. It is lighter than steel, has a hardness similar to copper and chemical and physical properties similar to titanium, being impervious to acids and alkalis.

The zirconium containing mineral zircon (zirconium silicate), and its variations were mentioned in biblical writings but the mineral was not known to contain a new element until 1789 when German chemist Martin Klaproth (who also discovered titanium and uranium) analysed a sample from Sri Lanka. Sir Humphry Davy in England tried in 1808 to isolate this new element using electrolysis – but failed.

It was not until 1824 in Sweden that Jons Jacob Berzelius did isolate the element, albeit in an impure form, by heating a mixture of potassium and potassium zirconium fluoride in an iron tube. A year later the iodide process, invented by Dutchmen van Arkel and de Boer, became the first industrial process for producing pure, if very expensive, metallic zirconium. It was another 15 years before William Kroll, initially in Luxemburg, but later in United States, developed the commercially viable process bearing his name, whereby zirconium tetrachloride is reduced by molten magnesium metal at 850°. The name zirconium is derived from Arabic and Persian words meaning gold-like.

Although zirconium metal is never found in the native state it is relatively abundant (ranking number 21 at 0.013%) in the earth's crust being 10 times more abundant than lead. It is mostly found as the minerals zircon (zirconium silicate) and zirconia (zirconium oxide). Some 1m tonnes of zircon are produced annually about one third of which is mined in Australia. Purified zirconium oxide has major applications in its own right, particularly in high grade industrial ceramics, and a crystalline form similar to diamond is used in jewellery.

Some 7,000 tonnes of zirconium metal is produced annually via the Kroll process, none in Australia, and almost all is used in water cooled nuclear reactors. The metal has strong corrosion resistant properties and its ability to confine fission fragments and neutrons means that thermal or slow neutrons are not absorbed or wasted and the efficiency of the reactor is improved. There are however a number of metallurgical uses in iron and steel one of which is to remove sulphur and nitrogen and thus improve iron's malleability, toughness and ductility.

Provided by the element sponsor sponsor David Meale

ARTISTS DESCRIPTION

Almost all zirconium produced is used in nuclear reactors, hence the cloudlike images used in this print. I have used strong red and grey colours to symbolise the emotions associated with the use of this metal, especially in the light as to what happened with the damaged Fukushima nuclear reactor in Japan (overheating of fuel rods and emissions of radiation clouds).

The name zirconium is derived from Arabic and Persian words, meaning gold-like. I have therefore used a metallic gold colour for the element symbol and atomic number.

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